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AGRICULTURAL Research

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REVEALING
see page 8

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL Research

Vol. 6—September 1957—No. 3

CONTENTS

More Room for Research.....	3
Our Search for New Attractants.....	7
How To Make More on Legs.....	10
In Case of Emergency—II.....	13

CROPS AND SOILS

Deep Tillage—When and How.....	4
Protecting Stored Peanuts from Insects.....	6

DAIRY

Blood Will Tell.....	8
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FOOD AND HOME

Tomato Powder Ready, Others on the Way.....	11
Want To Know: Potatoes, Fabrics.....	11

LIVESTOCK

Rats Carry Atrophic Rhinitis.....	12
-----------------------------------	----

AGRISEARCH NOTES

History, Current and Past.....	15
Finding More Fire Ants.....	15
Antibiotics and CRD.....	15
Swine Semen Ships Well.....	15
Camellia Flower Blight.....	16
Selling Produce Jointly.....	16
Egg's Inner Barrier.....	16

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Bonanza!

How much is a research discovery worth? So many factors are involved that it's usually hard to say.

One amazing answer came in a recent issue of Florida Agricultural Experiment Station's Research Report. Example: discovery of the need for minor elements in citrus production.

It's estimated that this single research achievement was worth \$91,530,000 in the 1954-55 season alone—nearly 3 times as much as all the State general revenue funds appropriated to the station during its entire history!

The industry quickly accepted these findings of the mid-thirties: identification of widespread deficiencies of magnesium, manganese, zinc, and copper; the nutritional plan worked out for their correction; the fertilizer and cultural practices developed to prevent recurrence of these deficiencies.

Research Report brings out graphically the difference between the production that could have been expected, as against the actual production following use of minor elements. This differential amounted to 81 million boxes in 1954-55. Cost of the elements themselves is small and they are incorporated into fertilizers and sprays that must be used anyway.

This is an impressive research bonanza. It's an unusually clear-cut example of the financial value of research.

Holiday?

A research victory sometimes gives folks the idea that everything is under control—that we can take life easy.

But nature is continually bringing up reinforcements. And it's not just the threat from new pests. No, it's also a matter of continuing change in crop pests we already have.

In some cases, we're finding ways to preview the changes. Scientists at Purdue Agricultural Experiment Station have isolated race D of hessian fly—capable of infesting wheats that have high resistance to prevalent races. So we're searching for resistance even before the race builds up.

We seem to be pushing the enemy back. But the war goes on. Nature never takes a holiday—nor can crop improvement.

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AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

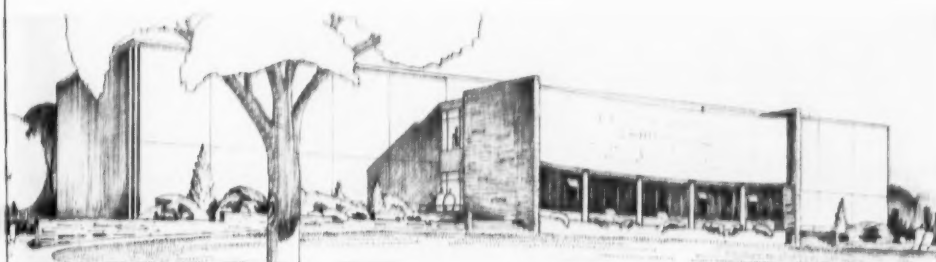
MORE ROOM FOR RESEARCH

Contracts let for larger, better laboratory facilities at four locations around the country

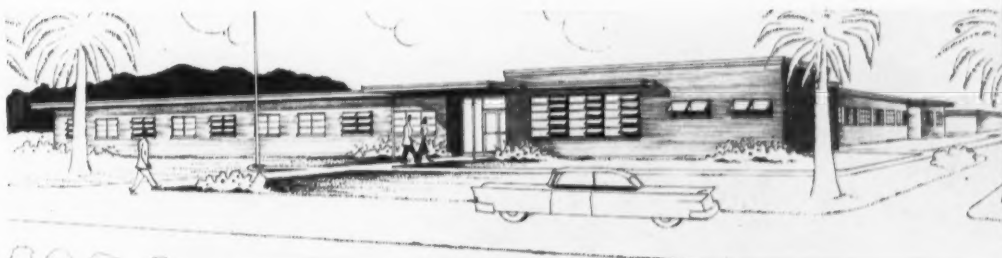
WINTER HAVEN, FLA.: Research will be carried out on vegetable and citrus products at a new lab costing \$635,000. Brick face, awning-type windows, and stone trim mark the design of the air-conditioned building.



FORT COLLINS, COLO.: \$405,643 laboratory will be built for storage of seed at the University of Colorado campus during the coming year. Air-conditioned building's concrete panels will give walls a geometric pattern.



WESLACO, TEX.: Facilities for horticulture, soils, and water experiments will be housed in a pink brick building costing \$319,871. It will have awning-type aluminum-framed windows that provide exterior lighting.



FACILITIES FOR RESEARCH will increase and be brought up to date within the next year thanks to Congressional appropriations for four USDA laboratories. General Services Administration awarded contracts to local builders for three of the projects. One was awarded by USDA.

The new National Seed Storage Laboratory will be built at Ft. Collins, Colo., to store germ plasm for use in developing better crops. ARS horticulture, soils, and water experiments will be conducted at Weslaco, Texas. Utilization of fruit and vegetable crops will be studied at a new building in Winter Haven, Fla. And a poultry brooder house will be con-

structed at the Agricultural Research Center, Beltsville, Md.

The seed laboratory will be constructed on the Colorado State University campus on a site made available through the institution. Independently controlled storage chambers for seed, a seed-germinating laboratory, and office space will be in the new two-story structure.

At Weslaco, there will be a one-story building with controlled variable temperature rooms for soil physics, chemistry, and fertility work.

Air-conditioned facilities will be built at Winter Haven, where frozen orange-juice concentrate was cooperatively developed by the Florida Citrus

Commission and USDA. There will be constant-temperature storage rooms. And one section will include a pilot plant for preparing food products, particularly from citrus crops, under controlled conditions.

The new poultry brooder house at Beltsville will provide scientists with more consistent environment for present experiments. Reduction of variables will help researchers obtain results faster since experiments will require less replication to check environmental effects. The house will be made of concrete and cement block with brick facings. There will be aluminum awning-type windows to reduce maintenance requirements. ☆

DEEP TILLAGE

When and How

Many factors are to be considered in the use of this emergency step



HEAVY DUTY CHISELS



NARROW CHISEL



DUCKFOOT SHOVEL

■ PROLONGED DROUGHTS and loss of ground cover in recent years on the Great Plains left many a soil-blown farm only one erosion-control measure—emergency tillage to create a cloddy surface. Chiseling 3 to 9 inches deep has proved effective against erosion if not practiced more than once a season on the same soil or too often over a period of years. But it's a temporary expedient to be recommended only for emergency use.

A cooperative study by USDA and the Kansas Agricultural Experiment Station shows that the effectiveness of the method is dependent on the choice of tool, on the speed, spacing, and depth of tillage, and on relations between these factors and the soil type and soil moisture level involved.

Best tool varies with soil

Agricultural engineer N. P. Woodruff and soil scientists W. S. Chepil and R. D. Lynch, of ARS, studied the problem for 2 years with the Kansas station at Manhattan, Garden City, and Hays. They obtained satisfactory surface stabilization by appropriate use of the lister, duckfoot cultivator, and narrow chisel.

A duckfoot cultivator was best to lift clods in loose, medium-textured soil. A narrow chisel (preferably the heavy-duty type for most conditions) was best on compact soils of substantial clay content. But when tilling at less than 2 miles per hour (sometimes necessary in plowing extra deep or with an underpowered tractor), or in extremely loose sandy soils, chisels

wouldn't bring up enough clods. Then listing was better.

Type of point used made little difference in cloddiness or stability of clods on the silt loam of Garden City. But on silty clay loam at the other two locations, narrow and heavy-duty chisels (especially the latter) produced more clods of higher stability, thus providing more durable protection. The duckfoot shovel made a rougher surface, therefore was more effective in reducing erosion when spacing between chisels was wide.

Speed's an important factor

Speed of tillage was the most influential single factor studied. In general, the higher speeds (above 3.5 m. p. h.) created more surface roughness and protection from erosion. The higher speeds increased cloddiness of the silt loam at Garden City but reduced cloddiness of the silty clay loam at Manhattan. At Hays, both high speeds and low speeds (2 m. p. h. or less) produced slightly more stable clods than did intermediate speeds. These tests showed that trials should be made at the beginning of emergency tillage and speed adjusted to produce greatest cloddiness under local conditions.

The rougher the surface, the more resistant it is to erosion by wind. Both clods and furrows help in roughening the surface. The more cloddy the soil and the closer the furrows, the rougher is the surface and the better its wind resistance. For example, chiseling at 27-inch spacings resulted

in 50 percent more roughness and 75 percent less erosion than chiseling at 54-inch spacings, researchers found.

Despite the greater effectiveness of narrow spacing, the two wider spacings were adequate under moderately erodible conditions, and preserved some undisturbed land and crop. Moreover, it took 5 horsepower more tractor power to pull narrow chisels spaced at 27 inches than those at 54 inches. Where tractor power is limited, the wider spacing may be necessary; under some soil conditions, duckfoot shovels would then be better than narrow chisels to bring up enough clods at the wide spacing.

Under comparable conditions, varying tillage depth between 3 and 9 inches had less effect than most other controllable factors in the Kansas studies. The most effective depth depended on speed and spacing of tool heads and other factors. As a general rule, the deeper the tillage, the greater the surface roughness produced. But the increased roughness was not enough in most cases to justify the extra horsepower required.

Method must fit conditions

All these factors had a somewhat varied influence on wind-erosion control at different locations. No rule fits every situation. Emergency tillage will be most successful where ample tractor power and tillage tools suitable for surface clodding are available—and where the farmers adapt the general principles mentioned above to their immediate situations. ☆

Effective Soil Treatments



COMPACT SOIL was protected by tilling with narrow chisels at a 5-inch depth, a 44-inch spacing, and a speed of 3.6 miles per hour.



ANOTHER COMPACT SOIL was clodded by tilling with heavy-duty chisels 3 inches deep, 27 inches apart, and at 3.7 miles per hour.



THIS LOOSE SOIL, tilled with duckfoot shovels 27 inches apart, 5 inches deep, and at 3.3 miles per hour, became relatively stable.

Ineffective Soil Treatments



TILLING TOO FAST (5 m. p. h.) on this soil shattered the clods. The firm surface was made loose and much more erodible than before.



TILLING TOO DEEP (9 inches) and at too slow speed created this mole effect. Clods aren't high enough to slow the wind effectively.



WIDE-SPACING chisels (54 inches) left wide, unprotected strips, which a heavy tractor pulverized and made more vulnerable to wind.

Protecting Stored Peanuts from Insects

Researchers are working on methods and materials to deal with warehouse pests that enter damaged shells

■ INSECTS INVADE cracked pods of stored peanuts. Specialists in USDA's Agricultural Marketing Service are trying to stop the loss with insecticidal aerosols and sprays.

Several species of moths and beetles seriously attack peanuts stored longer than the first winter after harvest. (The price-support program necessitates storing farmers' stock peanuts into the following summer.)

Piles of peanuts, weighing hundreds of tons, are kept in various types of warehouses—some of them also used to store tobacco or cotton seed. On an average, 25 percent of the peanuts in each warehouse usually have ruptured shells caused by harvesting and drying practices. Stored-product insects seldom penetrate sound pods.

Moths infest surface layers of bulk-stored peanuts. The larvae do the damage. The almond moth (*Ephestia cautella*) and the Indian-meal moth (*Plodia interpunctella*) spin silk threads that web nuts together in a serious infestation. These insects also attack sacked peanuts, leav-

ing a webbing on the outside of the bags. The moths also are detected when they fly to windows or light.

But the beetles are difficult to see. They include the sawtoothed grain beetle (*Oryzaephilus surinamensis*), the flat grain beetle (*Laemophloeus pusillus*), the Cadelle (*Tenebroides mauritan*), and the flour beetles such as *Tribolium confusum* and *T. castaneum*. These insects work near the bottom of bulk loads and the damage is not apparent until the peanuts are removed from storage.

AMS entomologists are conducting applied research at the Georgia Agricultural Experiment Station at Tifton. Aerosols containing pyrethrum, the most promising insecticide, are used in cooperating warehouses to prevent insects invading stock piles. The aerosol kills any exposed insects and also leaves a light deposit that repels insects for a few days.

Warehouse should be cleaned

Peanuts are usually free of stored-product insects when brought from

the field. But old infested peanuts are often lodged on beams, ledges, window sills, elevators, conveyors, and other areas of the warehouses. These sources must be cleaned up before warehouses are filled, and a residual spray must be applied to the walls and floors of empty buildings.

Protective treatments tried

But protective treatments appear best. Entomologists want a material to kill insects without leaving an undue amount of residue. On an experimental basis, they are using pyrethrum, methoxychlor, and malathion.

Samples collected with a tubular probe are used in determining number of cracked pods, amount of infestation, and degree of residue. Supplemental research is done at the USDA laboratory in Savannah. There are elaborate laboratory facilities for comparing formulations and making chemical analyses. Residues on the pod are first analyzed. Then the peanuts are shelled to determine whether any residue reached the kernels. ☆

WEBBING, caused by moths spinning silk threads, is easy to see. The insects web nuts together, causing considerable spoilage. Extension of damage is prevented with 10-percent methoxychlor solution.



SAMPLING peanuts shows the extent of difficult-to-see beetle damage. Two researchers use probe to obtain samples of peanuts for examination. Nuts, from all the way through the stock, fill probe.





Our search for

New Attractants



Recent successes have encouraged scientists to screen hundreds of potential sources

■ **NATURAL AND SYNTHETIC** attractants, which radiate luring "scent waves" to lead insects to their doom, are sought by USDA scientists as weapons to combat these pests.

Three attractants proved effective last year in the Mediterranean fruit fly eradication campaign operating in Florida under Federal-State direction. And male gypsy moths on nearly 3 million acres of forest land in New York, New Jersey, and Pennsylvania have been trapped by another attractant in the Federal-State eradication effort in those States.

With the Medfly, both natural and synthetic attractants have been used to lure flies into traps to detect their presence and abundance in an area. In addition, a food-like attractant mixed with insecticides lures flies to consume the lethal bait.

The synthetic lure and protein hydrolysate bait that spearheaded the Medfly effort were discovered, developed, and tested by ARS chemists and entomologists at the Agricultural Research Center, Beltsville, Md.

Materials aid in many ways

The attractant used against the gypsy moth is prepared from female gypsy moths. It lures male moths to baited traps from distances of at least a half mile. Catching the males is a means of checking the degree of kill from spraying the foliage-eating larvae this season. Combined with manual scouting, it is also a means of locating egg masses that will produce

larvae next season. The need for spraying next year can be determined by the number of egg masses that are found in a given area this year.

Screening covers two groups

Success of the attractants used has encouraged the search for new natural and synthetic compounds that will be effective not only for Medflies and gypsy moths but also for many other destructive insects.

Beltsville chemists are screening hundreds of natural plant material and many organic synthetics. Workers have already turned up several new attractants. Common weeds, obnoxious plants, vegetables and flowers are among the plants investigated.

Each plant material is put through two separate extractions. One process, using ethyl ether as a solvent, removes the coloring matter, fats, and waxes. The other process, using alcohol, removes the sugars, albumins, alkaloids, and saponins.

Work with organic synthetics embraces an entirely different field of effort. As in the case of natural materials, initial work with synthetics is usually done without prior knowledge that they will be attractive. But the development of one attractant from a given organic synthetic frequently leads to development of other and sometimes more effective compounds from a related material.

An example is the initial discovery in Hawaii that the propyl ester of 6-methyl-3-cyclohexene-1-carboxylic

acid prepared at Beltsville attracts male Medflies. Next, the isopropyl ester of the same organic synthetic was prepared at Beltsville and proved superior in field tests in Hawaii. This compound was then made in commercial quantities for use in the Medfly eradication effort until more recent synthesis of a third and more attractive compound—the sec-butyl ester—from the same source.

This new compound has replaced the first two synthetics. Furthermore, it is now being used to replace angelica-seed oil, a natural attractant now practically unobtainable, as a lure to bait more than 50,000 traps distributed through Florida.

All related compounds tried

In working with any organic synthetics, every possible chemical variation of an attractant material is tried and tested before it is tossed out. Thus in some cases, 100 or more related compounds may be prepared in the effort to make certain that no possibility is overlooked.

Most of the tests are made at USDA entomological research stations, where there is opportunity to field-test the various attractants on several kinds of insects. An example is the Fruit Fly Research Laboratory in Honolulu, Hawaii, where the Mediterranean fruit fly, oriental fruit fly, and melon fly are common inhabitants.

These and other insects are destined to run up against even more effective scents in future invasions. ☆

Usefulness of our increasing knowledge of blood types among dairy cattle gives new meaning to a familiar old saying:

Blood Will Tell

■ THERE'S AN OLD ADAGE, regarding man's ancestry, that "blood will tell." State experiment stations, some in co-operation with USDA, have shown that blood types do tell a lot about the genealogy of a cow.

Blood types—inherited characters—are settling questions of doubtful parentage of dairy calves. They are helping to safeguard the registration system of purebred dairy cattle. And accumulating knowledge of genetics of blood factors, which make up the blood-type, may some day bring important advances in livestock breeding.

The possibilities of any two cows other than identical twins having identical blood types are quite remote. Therefore, the method is considered practically the equal of human fingerprinting for identification.

The ARS Animal Husbandry Research Division, the University of California School of Veterinary Medicine, the Ohio, Wisconsin, and Wyoming experiment stations, and laboratories in Canada, Sweden, Norway, Denmark, the Netherlands, and Great Britain are cooperating in blood testing in two ways. First, the laboratories are utilizing ARS as a central agency in connection with their repeatability and standardization studies on blood-typing reagents (testing fluids). Second, ARS furnishes blood samples from the Beltsville dairy herd to all the laboratories to assist them in checking the reliability of their

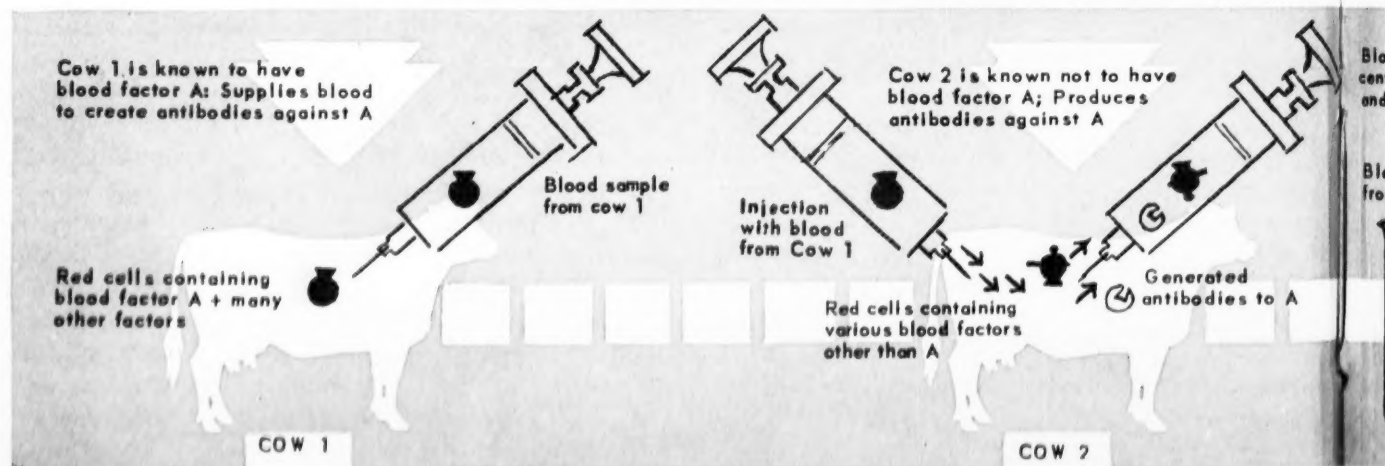
reagents and in determining the specificity of new reagents they may be developing for use in this work.

All these institutions are intensively studying the antigenic factors (blood types) of dairy-cattle blood. Antigens are substances that produce antibodies when blood from one animal is introduced into the bloodstream of another. It is well known that in human blood transfusions, the antigens of a donor may produce antibodies in the recipient—may even cause his death—unless the antigenic factors of both persons are the same.

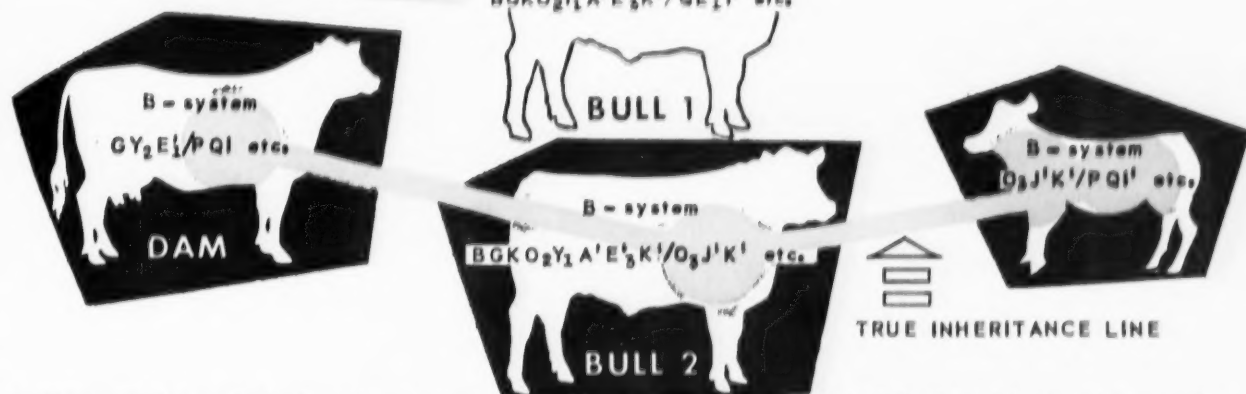
The researchers are particularly interested in the principles of inheritance of blood types. Future work may include efforts to learn whether blood types are related to any other characteristics of cattle.

Blood types in cattle are based on existence of some 50 antigenic factors—far more than humans have—which can be brought together in millions of distinct combinations. Each combination is a blood type. These antigenic factors owe their existence to the presence in animals of specific genes, the carriers of inheritance. There are literally hundreds of genes controlling the combinations of blood factors, but only a small fraction of those genes can be present in any one instance. This explains the tremendous odds against any two cows other than identical twins having exactly the same blood type.

HOW TO TELL WHETHER A COW



HOW TO USE BLOOD TYPE TO TRACE ANCESTRY



To illustrate the method of testing parentage, consider an abbreviated list of the blood factors, by genetic combinations, involved in one such case:

AH SYSTEM	B SYSTEM	C SYSTEM	F-V SYSTEM	J SYSTEM
Bull 1 -- A ₁ /H	BGKO ₂ Y ₁ A'E' ₃ K'/QE ₁ I'	C ₃ /WX ₃	F/F	J/I
Bull 2 -- A ₁ /H	BGKO ₂ Y ₁ A'E' ₃ K'/O ₃ J'K'	C/WX ₃	F/F	J/I
Dam -- a/a	GY ₂ E ₁ /PQI'	X ₂ L ₁ /c	V/V	I/I
Calf -- A ₁ /a	O ₃ J'K'/PQI'	WX ₃ /X ₂ L ₁	F/V	I/I

The inherited combination O₃J'K' of the calf was not found in either its dam or bull No. 1, so the latter could not be the sire. Bull No. 2 could, however, have supplied the O₃J'K' part of the calf's inheritance and is, therefore, the sire if these are the only bulls in question.

The constituent blood factors (identified by letters), especially the combinations, may be similar among close relatives. Breeds of cattle differ in the frequency with which various antigenic factors and combinations of them occur. For example, the factor J' occurs in about 12 percent of the Holsteins but rarely if ever in Guernseys. The combination GY₂E₁ is associated with Holsteins, B₂GD' with Jerseys, PQI' with Guernseys.

Once a cow's blood type is known, it will continue to identify her for the remainder of her life. The one limitation on this is that blood type won't distinguish between identical twins or between those fraternal twins whose blood intermixed in the embryo stage.

The serology laboratory of the University of California School of Veterinary Medicine types all bulls used in artificial insemination in the United States under an agreement with the Purebred Dairy Cattle Association. The laboratory also types the calf and dam in each case of challenged paternity. Knowing what kind of blood factors (antigens) the dam could transmit, the laboratory can determine whether the additional blood factors found in the calf's blood could have come from the bull that the semen supplier claims to be the sire.

The various dairy breed associations of the country also submit cases of doubtful paternity to the California laboratory for determination of calves' true parentage. ☆

COW HAS BLOOD FACTOR A

Blood from Cow 2, centrifuged to separate serum and red cells into layers

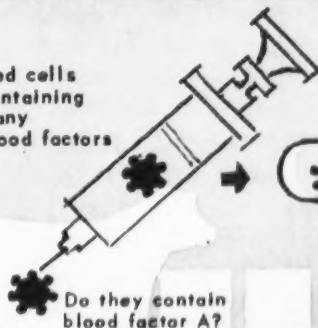
Blood sample from Cow 2



Immune serum with anti-bodies to A

Red cells

Red cells containing many blood factors



Do they contain blood factor A?

Does Cow 3 have factor A?

Cow 3 blood

Cow 2 serum

Yes! Test serum hemolyzed Cow 3's blood sample, showing she really has blood factor A

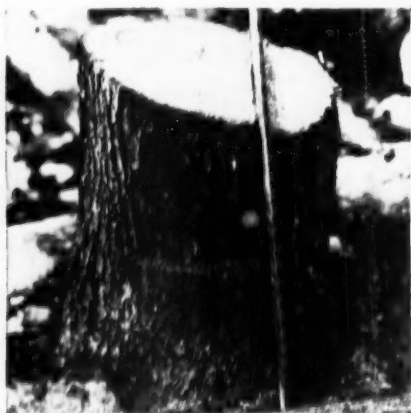
COW 3

HOW TO MAKE MORE ON LOGS

Foresters found that a little planning prior to cutting can increase quality and volume



TOP MATERIAL is wasted. One 12-foot log was taken below the cut, leaving this section in the woods: surface clear, 2 feet high, 17-inch diameter inside bark. Twenty-three board feet of high-quality material were wasted by underutilizing the top material below the fork.



STUMPS should be cut as low as possible. Here are 10 inches free of surface defects that could be used as high-quality material.

■ **TIMBER OPERATORS** can increase profits by cutting logs for better quality and greater volume. These are the conclusions of a USDA study by the Central States Forest Experiment Station of the Forest Service.

The report shows that 34 percent of the volume of the sample trees could have been cut into high-quality logs in contrast to the 23 percent so



JUMP-BUTTS aren't always necessary. By careful planning, logs may be cut to eliminate cull material, provide standard sizes.

cut by the local woods workers. At the same time, board-foot volume could have been increased 41½ percent by improved log cutting.

Proper cutting easy to plan

Volume and quality were raised with little extra effort. Men walked the length of a fallen tree and planned before cutting it into logs.

Logs from more than 200 black-oak trees were measured and graded for quality as they were actually cut by the woods workers. Results were compared with the volume and grade of material that could have been cut from the same trees. Sample tree diameters ranged from 14 to 32 inches with merchantable height from one-half to three 16-foot logs. The trees were taken from 10 different logging operations in southern Illinois.

The study shows profits are higher if crews plan to cut for maximum volume as well as the best grade. Planned cutting of logs increased volume in 8-, 10-, and 16-foot logs, but average log length was 12.5 feet with both planned and unplanned cutting. The unplanned way gave a volume of 53,768 feet compared to 56,242 feet (2,474 more) obtained by forest economist Roy A. Whitmore, Jr., and technologist Willard Jackson.

Better use increases return

Full use of merchantable material at the tops of the trees as well as at the stumps was accomplished by using the best possible combination of 10-, 12-, 14-, and 16-foot logs. The length of jump-buts (defective sections near stumps) was minimized to reduce waste as much as possible.

As crews cut for increased volume, they also produced more high-grade logs. Log lengths were varied in order to give maximum clear lengths in certain logs and to throw knots, holes, and bud clusters in poorer logs. Logs were cut so that crooks came at or near the ends in order to minimize the loss of quality timber.

The black-oak trees harvested during the study yielded lumber worth about \$4,110. If the same trees had been cut for optimum value and volume, the lumber would have been worth \$4,616, an increase of \$506.

Timber cutters can be encouraged to cut logs for quality by offering more pay for higher grade logs. ☆

Tomato powder ready, other products on the way

■ **TOMATO POWDER**—for sauce, soup, juice, dry prepared mixes—will soon emerge for commercial use. This climaxes several years' work at USDA's Western Utilization Research and Development Division, Albany, Calif. (AGR. RES., September 1954).

The powder mixes readily with water. Packaged to keep moisture content low, it holds its quality even under severe storage conditions.

Tomato powder is only one of several useful and practical instant tomato products being developed or improved at the Western laboratory. For instance, improved methods developed by researchers here for preparing concentrated tomato paste (for soups, catsup, etc.) are already being used by some commercial firms.

The researchers are now studying the effects of concentrating tomatoes beyond the usual level of 26 percent solids. This study was prompted by rising costs of preparing, packaging, and transporting processed items. The higher the density of the tomato product, the greater the saving.

Much has been known about factors affecting tomato color, consistency, and vitamin C content, but little has been done on flavor and other factors related to concentration. Studies by ARS biochemist Marvel-Dare Nutting produced findings of value for consumers and processors.

In testing products with solids contents of 5.6 percent (ordinary single-strength juice) to 33.4 percent (very thick concentrate), scientists found that flavor, color, and vitamin C decreased as concentration, processing time, and temperature increased. Excellent products can be had, though, at all the various concentrations.

Laboratory researchers have also contributed to the mechanism of evaporation in the concentration process. They conducted extensive studies on injection of steam into chopped tomatoes as a preheating step. Their flash-entry evaporators are now widely used in commercial plants. The evaporators, used also in concentrating fruit juices and purees, help maintain quality and output.

Two products—heat-processed tomato-juice concentrate prepared at low evaporation temperatures and frozen tomato concentrates—are being investigated at the ARS Pasadena laboratory. Researchers there are studying evaporation methods and temperatures as related to flavor, vitamin C, and other quality factors.

Scientists found that heat-processed products are slightly more flavorful after storage if the temperatures are held below 150° F. during evaporation under vacuum (in plants where flash entry is not used).

Development of concentrate for beverage use—similar to concentrated orange juice—brought out some interesting facts about tomatoes. Their flavor is much less volatile than that of citrus and other fruits. It is possible to retain good flavor, therefore, while heat-processing to inactivate enzymes and sterilize for canning. In fact, the common single-strength canned tomato juice has established the standard of preference among tomato-juice drinkers. ☆

What consumers want to know: potatoes, fabrics

■ **TWO NEW BULLETINS** add to the USDA series called Facts for Consumer Education. One on potatoes, due soon, is the seventh of the food studies. And one on clothing, already out, extends the series to textiles.

The semitechnical publications provide reliable source material for extension workers, home economists, and teachers to pass on to their groups. Marketing specialists, writers, and many others can use the information in their work with consumers.

These studies were made by the Institute of Home Economics on recommendation of an advisory committee to USDA made up of groups that need such material. Researchers gather facts available on a commodity from technical specialists in Federal and State agencies, manufacturers, and trade associations, and comb literature for published material. After evaluation for scientific soundness and usefulness to consumers, the data are summarized and published.

In the potato bulletin, ARS food economists Lillian J. Fincher and Beatrice M. Mountjoy point out that few foods offer as much as potatoes in nutrient value for money spent. In the 1955 Household Food Consumption Survey (AGR. RES., January 1957, p. 8), families reported they spent about 2 percent of their weekly food budget for potatoes. For this 2 percent, they received 10 percent of their ascorbic acid; 4 to 6 percent of their iron, niacin, and thiamine; 2 to 3

percent of their riboflavin, protein, and food energy for the week.

Cooking quality of potatoes is usually associated with texture or degree of mealiness, color after cooking, and flavor. The best practical test is specific gravity separation (AGR. RES., January 1955, p. 14). High specific gravity means mealiness—desirable for mashed, baked, or french-fried potatoes. Potatoes with low specific gravity are fine for creaming, pan frying, or salads.

In the fabric bulletin, clothing specialist Margaret Smith describes elements that make up quality in fabrics. Facts on present-day fibers and fabric construction and finishes are brought together to help purchasers select the fabric best suited to the purpose. Photographs show closeups of fabrics from manmade fibers as well as from natural fabrics—cotton, wool, silk, and linen. Various weaves, knits, and patterns are also illustrated and described.

Labels are an important guide to fabric quality. They indicate fiber, colorfastness, shrinkage, and finish. This bulletin defines terms that are used on labels, to help a consumer get full information from them.

Other bulletins in the Facts for Consumer Education series cover tomatoes, peaches, beef, pork, milk, and bread. These publications may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. ☆

ESTOCK · LIVESTOCK · LIVESTOCK

Rats and other mammals carry atrophic rhinitis

■ RATS MAY BE CARRIERS of atrophic rhinitis—a serious disease affecting the nasal structure of swine and commonly called “crooked snout” (AGR. RES., November 1956, p. 12).

Other animals such as cats and rabbits have already been shown to be carriers. Experiments at USDA's Agricultural Research Center, Beltsville, Md., suggests that there may be other natural carriers as well.

Soon after atrophic rhinitis was found in a Beltsville swine herd several years ago, characteristic lesions of the disease were found in weanling pigs that had not come in contact with sick animals. At the same time, several cats with respiratory disorders were noticed around the barns. (This was before cats were shown to be carriers.) These two observations led ARS parasitologist L. A. Spindler to consider the possibility that other mammals besides swine could be carriers of atrophic rhinitis. Hence, J. S. Andrews, F. L. Earl, L. S. Diamond, and Spindler launched an investigation to see if rats could carry the serious “crooked snout” disease.

Eleven experiments—each involving 2 to 20 albino rats and a litter of young pigs—were conducted during a

3-year period. Rats were instilled with infectious nasal scrapings from pigs in a herd naturally infected with atrophic rhinitis. The rats were then killed. Infective material was taken from their nasal passages and instilled 1 to 9 times into disease-free pigs 3 to 27 days old. Beginning 15 to 30 days after infection, pigs were checked periodically for atrophic rhinitis by rhinoscope (instrument to examine nasal passages for any abnormality) and by post mortem examination at the end of the experiments.

Two-thirds of the pigs—all 26 days old or younger—developed characteristic lesions of atrophic rhinitis. Lesions were first seen by rhinoscope 15 to 45 days after the first instillation of disease material. This interval was not found to be related to the number of instillations made.

Rats hold infection 3 weeks

When infectious material was allowed to remain in the rats' noses from 9 to 26 days and was then instilled into disease-free pigs, atrophic rhinitis resulted. After as long as 23 days in the rats, however, the infectious material did not produce the disease in pigs. Indications are that the

optimum time for the disease-producing agents to remain infectious in rats' nasal passages is about 21 days.

Pig, rat materials compared

In similar studies, Andrews and Earl showed that atrophic-rhinitis lesions usually developed within 24 to 51 days when young disease-free pigs were given material from the noses of infected pigs. The shorter interval—15 to 45 days—required for lesions to develop when infection comes from a rat may mean infection is more potent from this source.

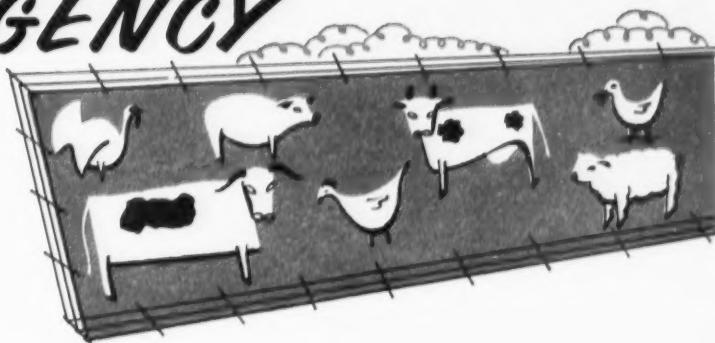
No pathological changes were seen in noses of rats instilled with infective material from diseased pigs.

Nasal washings and scrapings capable of producing typical lesions of atrophic rhinitis in pigs did not necessarily originate in pigs having atrophied turbinates (a sign of advanced disease). This means that pigs that haven't developed these lesions can still be an important factor in transmission of the disease.

Quick-frozen infective material stored 3½ to 11 months produced infection in pigs only when given to them directly. It did not produce the disease after passage in rats. ☆

In case of **EMERGENCY**

Cooperating Federal and State workers stand ready to move in on outbreaks of animal disease



PART 2—LIVESTOCK

■ OUR PLAN FOR handling biological warfare on livestock is based on an extension of our peacetime activities in (1) keeping out foreign diseases, and (2) getting rid of them if they manage to slip past our borders.

If they do slip past, we must be able to *recognize* and *eradicate* them quickly. This is where we're concentrating our efforts to prepare for biological warfare. Here's what has been done so far in our emergency plan for animal-disease control:

Nationwide training programs have been set up and teaching materials have been made available for veterinarians, staffs of veterinary colleges and commercial biologic houses, and veterinary students. These materials are designed to inform veterinarians of the dangers of foreign animal

diseases, and how to recognize, prevent, and control them.

USDA, with the cooperation of Federal Civil Defense Administration and Department of Defense, has made many films for professional audiences on clinical and pathological aspects of foreign animal diseases. These films—on African swine fever, blue-tongue, rinderpest, scrapie, and others—are available at the extension film library of the agricultural college in each State. Or they may be obtained at USDA Motion Picture Service, Washington, or the film library of the American Veterinary Medical Association, located in Chicago.

Color slides showing symptoms and lesions of various animal diseases are being circulated to help in identification. These slides are available from

the veterinarian in charge of animal-disease eradication in each State and have been distributed to schools of veterinary medicine.

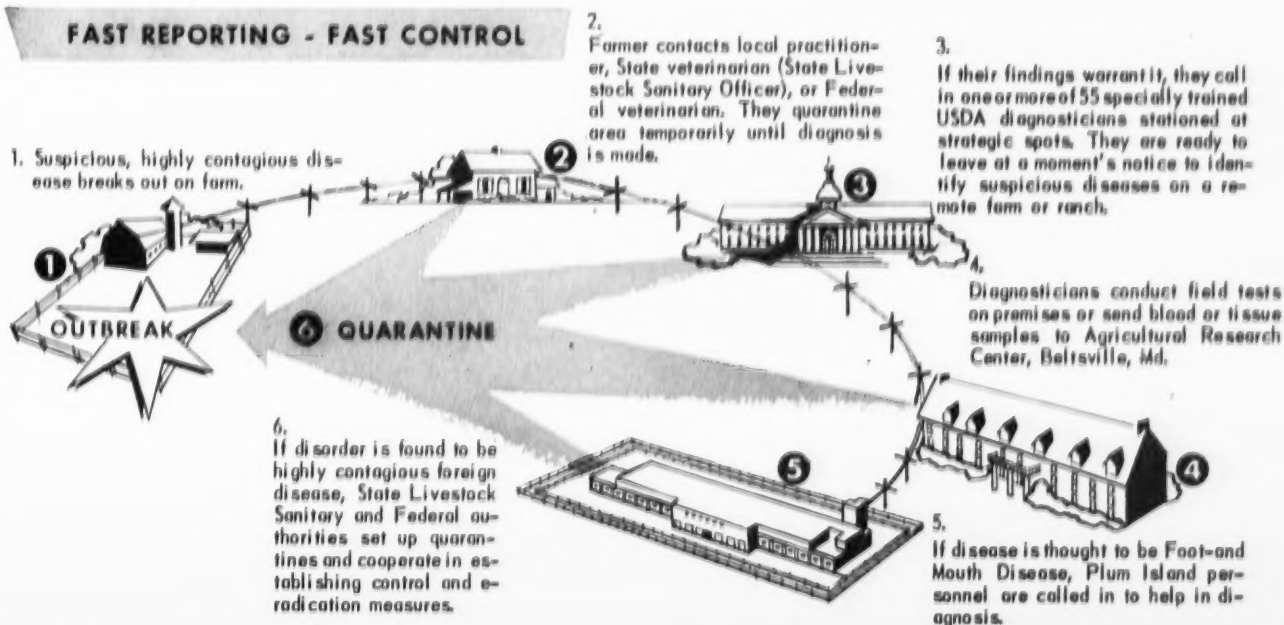
A committee of the United States Livestock Sanitary Association—composed of State and Federal veterinarians—has published a book on foreign animal diseases. This supplements veterinary medical texts.

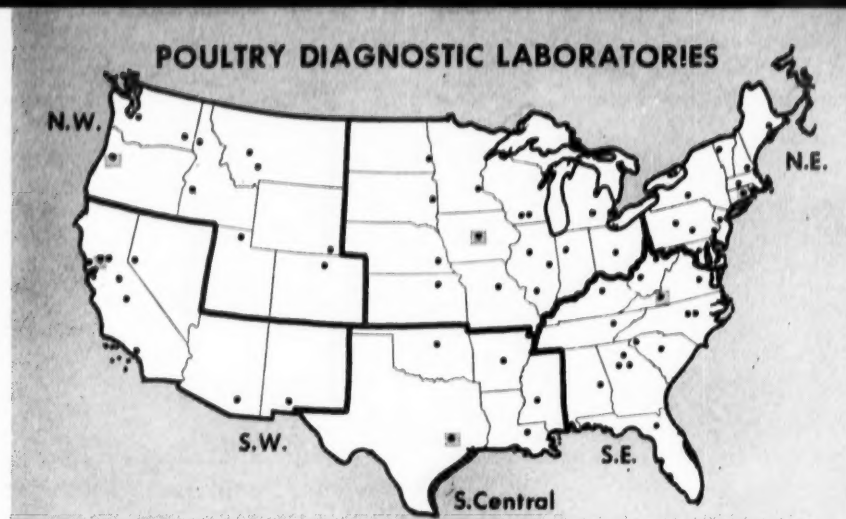
New findings made available

ARS has scientists in several countries to study infectious foreign animal diseases. It also has a laboratory at Plum Island, N. Y., for research on foot-and-mouth and other potentially dangerous foreign diseases.

USDA is continually developing and distributing information on unusual or foreign animal diseases that

FAST REPORTING - FAST CONTROL





FAST DIAGNOSIS of poultry disease is possible through use of specialized laboratories throughout country. Under emergency plan, country is divided into six areas, each headed by a poultry-disease specialist. Well-equipped diagnostic laboratory with experienced personnel in each area serves as reference laboratory for others in area. If a suspicious disease can't be diagnosed in specially equipped laboratory, specimens are sent to reference laboratory. ARS and State officials are working to expand plan to include large-animal diagnosis.

could be used as biological warfare agents. Border quarantine inspections have been strengthened. Federal and State Emergency Disease Control Organizations have been developed in every State, can operate in any community on short notice.

And only recently, ARS has issued a booklet telling farmers how best to protect themselves, their families, livestock, and crops against radioactive fallout after a nuclear attack. Members of the USDA emergency staff work closely with FCDA to inform farmers of dangers they may face from use of atomic weapons.

Emergency setup moves fast

Veterinarians at key spots in the Nation have received special USDA

training in diagnosing unusual or suspicious diseases. Once a disease has been diagnosed as dangerous, the emergency plan goes into action.

This is how the emergency organization is set up to do its work:

It operates mainly at the State level and is headed by a State and a Federal veterinarian in each State. Normally, the Federal veterinarian coordinates Federal-State regulatory work and the State veterinarian is responsible for regulatory work within the State. One of these two veterinarians is designated in advance to head up emergency activities.

In case of an outbreak of foreign disease, the emergency State organization will go into action. The designated veterinarian will immediately

assume responsibility for all emergency regulatory work. He will hire additional personnel, buy supplies, and provide maintenance as needed.

Field units will immediately be set up to handle local emergencies. Veterinarians to head these units have been selected in advance or will be picked by the emergency State head.

Arrangements have been made for State agencies such as the National Guard and highway patrol to assist in maintaining quarantines. State and Federal forestry and highway departments will provide earth-moving equipment for carcass disposal.

USDA marketing agencies will help with livestock, meat products, and feed marketing and distribution. An Emergency Advisory Board has been established at USDA regulatory headquarters in Washington to advise on critical problems that may arise.

Diagnostic facilities expand

In the field of foreign poultry disease control, we have developed a practical and efficient plan of diagnosis. (See map.) ARS and State regulatory officials are now working to expand this plan to include facilities for large-animal diagnosis.

Much responsibility for success of foreign-animal-disease control rests with farmers and stockmen, who must recognize the need for prompt reporting of suspicious disorders.

Next month, we'll hear what planners are doing to protect against biological warfare on our crops. ☆

HOW LIVESTOCK OWNERS CAN HELP AGAINST BW

1. Take all normal sanitation measures to minimize the spread of disease—domestic or foreign.
2. Check all animals regularly for disease signs.
3. Isolate all new livestock for at least 10 to 14 days to be sure they do not carry disease.
4. Report unusual diseases or an increase in native diseases to a veterinarian immediately. Time is important.
5. Follow all approved vaccination practices for any diseases that may be found within the area.
6. Carefully dispose of wastes and discharges of sick animals, and carcasses of dead animals.
7. Do not visit any infected or quarantined farms.

History—current and past

Golden-nematode cysts were found aboard the Mayflower II by USDA plant-quarantine officials in Provincetown Harbor, Mass. The ship was checked in June after the 53-day voyage from Plymouth, England. ARS inspectors found that contaminated soil had sifted from 50 bags of potatoes onto 40 tons of cargo.

Each piece of cargo was brushed by inspectors before the load was hoisted to the dock. Five bags of potatoes not used during the trip were found, and soil recovered from the potatoes and cargo was examined. Cysts were washed from the soil.

Authorities say if plant-quarantine examinations had begun 337 years ago, when the original Mayflower docked at Provincetown, instead of in 1912, crop damages would now be considerably smaller. The hessian fly, San Jose scale, chestnut blight, European corn borer, gypsy moth, and other pests might never have been found in the United States.

Finding more fire ants

USDA-State surveys continue to locate infestations of the destructive imported fire ant. This ant builds hard-crustured mounds as high as 2 feet, with as many as 200 mounds per acre. The pests have spread throughout the Southeastern States.

Over 27 million acres of land are infested in Georgia, Florida, Alabama, Louisiana, Mississippi, Arkansas, South Carolina, and Texas. Arkansas treated about 12,000 acres in June, including 3,000 acres in El Dorado. This "all-out" eradication effort of a relatively large but isolated infestation is being followed with interest. The pests have been located and

eradicated in earlier campaigns in Tennessee and North Carolina.

ARS specialists assigned to surveying general insect conditions are inspecting mounds in cooperation with State agencies. Species resembling the fire ant also build mounds. Identification is made by microscopic examination. The most common im-



ported fire ant is $\frac{1}{4}$ to $\frac{1}{8}$ inch long, red with a pale yellow band at the base of the black abdomen. Some are brown to black with an orange band on the base of the abdomen.

Humans and animals are stung by the fire ants—so-called because of a painful sting. Young citrus plants, germinating corn, and vegetables are destroyed. The damp earth of the mounds clogs farm machinery.

Research has shown that heptachlor, dieldrine, aldrine, and chlordane destroy ants if the materials are properly applied. Scientists are studying formulations to develop treatments that have long residual effects but do not leave excessive residues toxic to crops and livestock.

Consideration is being given to starting research on attractants as well as to restricting movement of articles likely to spread insects.

Antibiotics and CRD

Injecting hens with antibiotics to produce noninfected chicks is not a sure-fire way to control CRD (chronic respiratory disease). This is shown by State-USDA research (AGR. RES., October 1956, p. 7).

Studies on CRD in chickens and infectious sinusitis in turkeys—similar

diseases—indicated that treated hens sometimes produced infected chicks and untreated hens sometimes produced healthy chicks. Segregating chicks and keeping small numbers helped produce disease-free flocks.

ARS tests showed disease-producing bacteria in affected birds can be reduced only by using large quantities of antibiotics. Hypodermic injection seems to be more effective than medicated feed or water. Studies are continuing on dosages and methods of administering antibiotics.

An experimental, rapid blood test for diagnosing CRD showed promise in tests, but more work is needed to develop new and improved testing techniques. Work will continue on factors influencing egg or contact transmission of the disease-causing agent, and on developing vaccines.

Swine semen ships well

A recent pilot test proved that swine semen can be shipped long distances with satisfactory results.

Samples collected and specially treated in Norway were received at USDA's Agricultural Research Center, Beltsville, Md., over a 15-day period in December 1956. Twenty-four sows were inseminated 30 to 40 hours after the semen was collected.

Eleven of the sows (46 percent) farrowed litters of strong, healthy pigs—averaging 9.2 per litter. Of these, 7.4 pigs (80 percent) were alive after 21 days. Pigs from these litters compared well in weight with normally bred Beltsville pigs.

Best results were obtained when the semen was kept at temperatures of 59° to 68° F. (Swine semen can't be frozen like semen from larger animals.) For instance, only 1 of the last 8 sows bred artificially at Belts-

NOTES AGRISEARCH NOTES AGRISEARCH

ville conceived. The last eight semen samples were flown across the Atlantic through storms and at low temperatures, which may have affected the motility and liveability of the sperm. Another possible reason for poor conception rate of later-bred sows is that semen quality at the time of collection may have been below average because of the short interval (only 24 hours) between collections.

It's possible, too, that the conception rate could be increased with more experience in insemination.

Camellia flower blight

The 10-year advance of a camellia flower blight has set USDA researchers in search of a control.

The blight, old in the Orient, showed up on the west coast in 1938 and in the East a few years ago. It has now spread in Maryland and Virginia and south and west into Texas. Fungicidal sprays haven't helped.

Scientists see hope in the behavior of the pathogen *Sclerotinia camelliae*, despite its rapid spread. ARS pathologist D. L. Gill is studying the prob-



lem with the Georgia Agricultural Experiment Station, Tifton.

S. camelliae doesn't spread directly from blighted blossoms to healthy ones. It bears only non-infective

sclerotia—resting bodies—on the flower. Those sclerotia must grow in soil and produce fruiting bodies that bear spores; the spores then scatter and infect other blossoms.

Brief though it is, the resting stage may give a chance to break the fungus cycle and reduce infection. Gill will explore the possibility of controlling the fungus in the soil.

Selling produce jointly

Many fruit and vegetable processors are interested in marketing products through a joint sales agency, according to a USDA survey.

Of 71 firms contacted in 18 States, 53 firms (74 percent) indicated interest in development of a coordinated sales plan. Farmer Cooperative Service agricultural economist I. W. Rust conducted the study.

Cooperative processors said they were willing to market jointly about 57 percent of their processed fruit, vegetables, and specialty items, and 40 percent of their packaged rice and dried beans and peas. They want to reserve the balance for established customers, at first. Substantial savings in transportation costs might be possible with regional rather than national distribution of products.

Firms differed regarding the kind of label. Some thought a common label would be best. Others said established labels should be used. Some suggested adding a small medallion on the corner, indicating the new organization marketing the product. Cooperatives interested in joint mar-

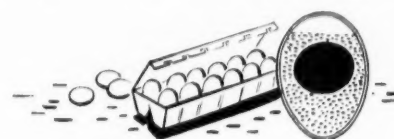
keting expressed willingness to meet uniform quality requirements.

Egg's inner barrier

Egg membranes and whites are natural barriers to bacterial spoilage, say USDA researchers at the Western Utilization Research and Development Division, Albany, Calif.

The membranes are effective bacterial filters. They held back all bacteria in tests with a suspension containing a million organisms per milliliter (about 1/30 of a fluid ounce). This filtration efficiency decreased markedly when the membranes were first kept in contact with bacterial suspension several days.

Egg membranes are nonporous and composed of proteins. This suggests



that the proteolytic (digesting) enzymes of the bacteria chemically alter the membrane before and while they pass through. A survey of bacteria isolated from spoiled eggs showed that bacterial ability to penetrate and grow in eggs is closely related to ability to digest proteins.

When bacteria penetrate the membrane, they contact protective antibacterial substances in the white. ARS tests showed that only 6 of 60 strains of bacteria (at levels of 100 to 3,000 per milliliter of albumen) survived and multiplied in white.